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California Institute of Technology  
Pasadena, California

*Atmospheric Infrared Sounder*

# **AIRS Level 3 Products**

## **AIRS Science Team Meeting**

### **Greenbelt, MD**

**November 30 - December 2, 2004**

**Stephanie Granger, Eric Fetzer, Sung-Yung Lee,  
Amy Braverman**



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## AIRS Level 3 Products Summary Description

- **Represents Level 2.**
- **Gridded statistical summary of the distribution of corresponding Level 2 parameters for a given time period within a grid cell (1°x1°).**
  - **Characteristics**
    - *Lower volume, less complex than Level 2.*
    - *Synoptic gridding (sort of).*
    - *Can be used to understand long term, global or large-scale regional behavior.*
    - *Serves as a guide to corresponding Level 2 data.*
      - Aid in identification of interesting regions, time period or artifacts.

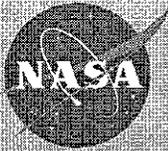


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## AIRS V4.0 Level 3 Products Overview

### *Atmospheric Infrared Sounder*

- One degree by one degree equal angle grid
- Daily, 8 day, and monthly summaries
- Means, counts and standard deviations
- Separate Ascending (1:30AM - 1:30AM) and Descending (1:30PM - 1:30PM)
- Parameters
- Separate microwave-only fields included
  - *Temperature, Water vapor (RH and MMR), Geopotential height profiles*
    - T profiles: 1000. - 1.0 mb
    - Water vapor profiles: 1000. 100. mb
  - *Cloud (height and fraction), total ozone, OLR (Clear and cloudy)*
  - *Emissivities (MW and IR), Cloud Liquid Water, Surface skin/air temperature*
  - *MW only Temperature and geo pot height profile*
  - *Total precip water vapor (MW only and MW/IR combined)*
- Special attention was paid to coastline grids
- Land/sea mask
- Version 4 level 3 can be run on version 3.0 retrievals from DAAC (with some blank fields)
  - *We should get two and one half year long time series soon*



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## Level 3 Pre-Release Testing

- **Feedback from diverse group of users**
  - ***Duane Walliser, Baijun Tian(JPL, Caltech)***
    - Madden-Julian Oscillation (MJO) Research
  - ***GENESIS Project (JPL, USC)***
  - ***Andrew Gettleman (NCAR)***
  - ***Scientific Visualization Studio (GSFC)***
    - GSFC
  - ***AIRS Science Integration Team (JPL)***
    - OLR comparisons with CERES
    - H2O comparisons - AIRS vs AIRS-MW-Only
  - ***Environmental Science Research, Inc. (ESRI)***
    - Applications Research Lab



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## Level 3

# Diurnal Cycle and Madden-Julian Oscillation Research

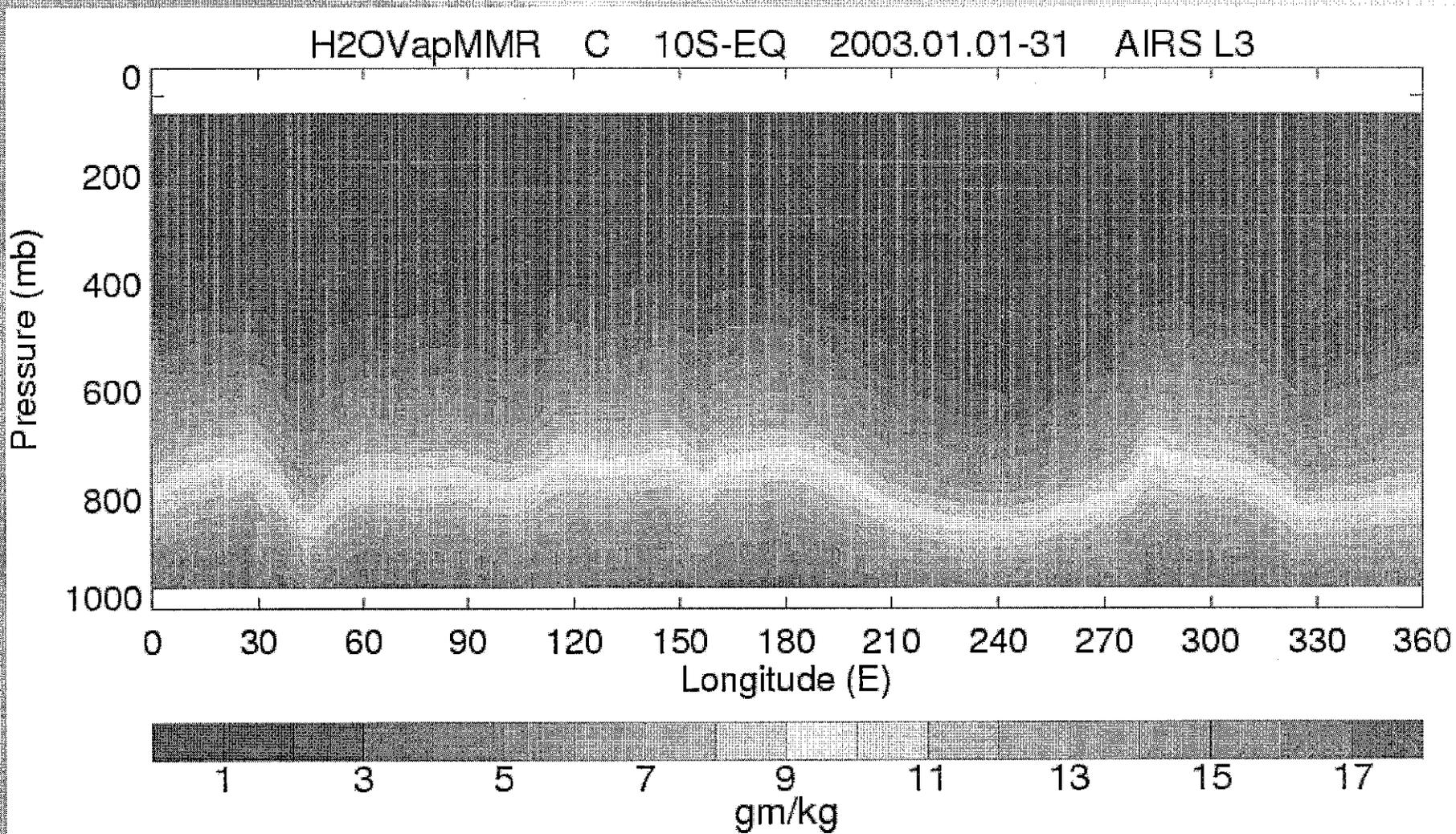
- **Duane Walliser and Baijun Tian**
  - *Analyze diurnal variation of water vapor and other physical quantities.*
  - *Seek to exploit the 3-D structure and high spatial/temporal resolution to understand spatial-temporal evolution of MJO.*
  - *Develop observational depiction of MJO evolution from AIRS and others (e.g., TRMM).*
  - *Compare with GMC to improve models.*
  - *Other climate studies such as moist static energy and stability analysis.*



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# Time-mean cross sections Walliser and Tian

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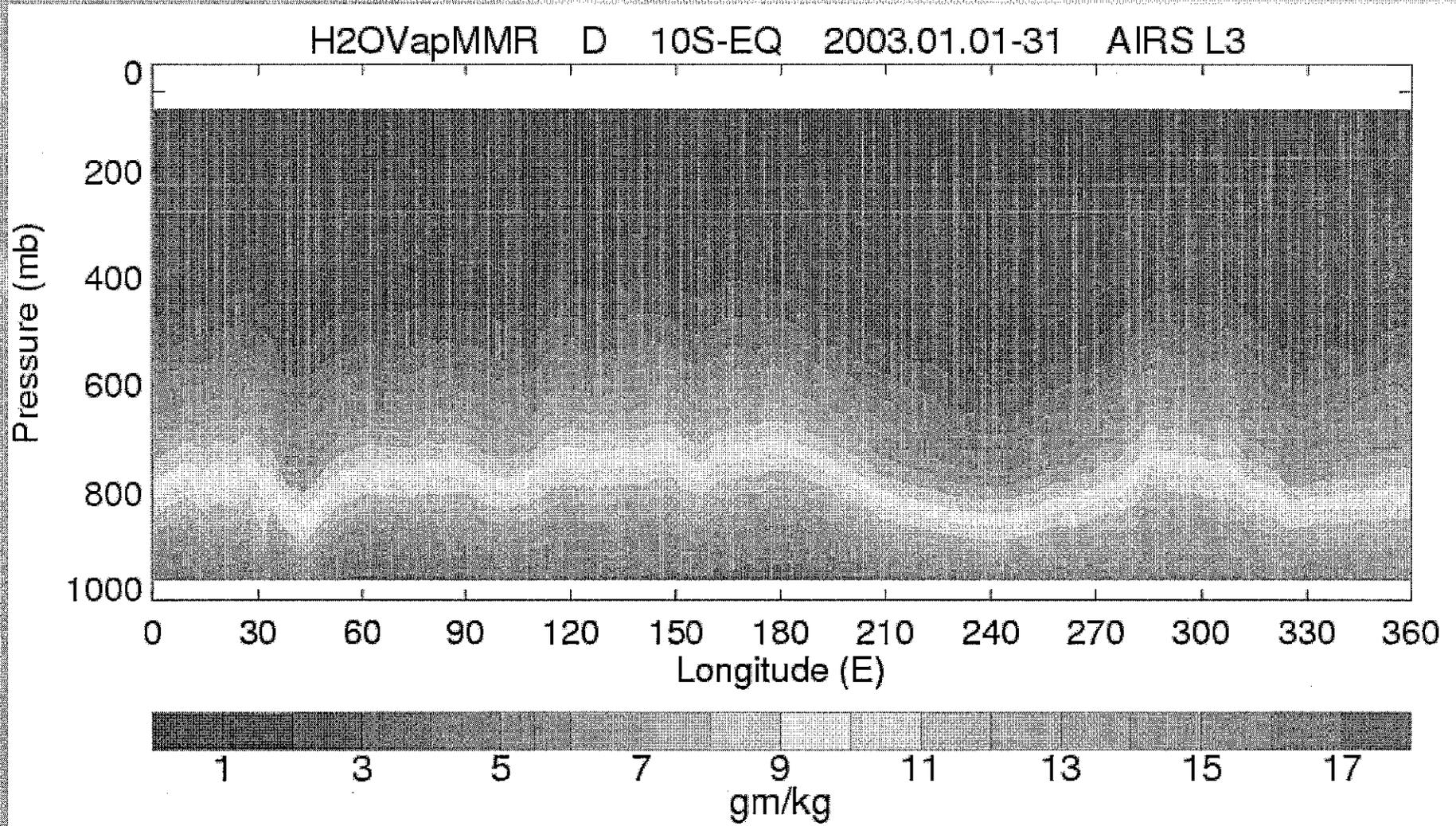




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# Time-mean cross sections Walliser and Tian

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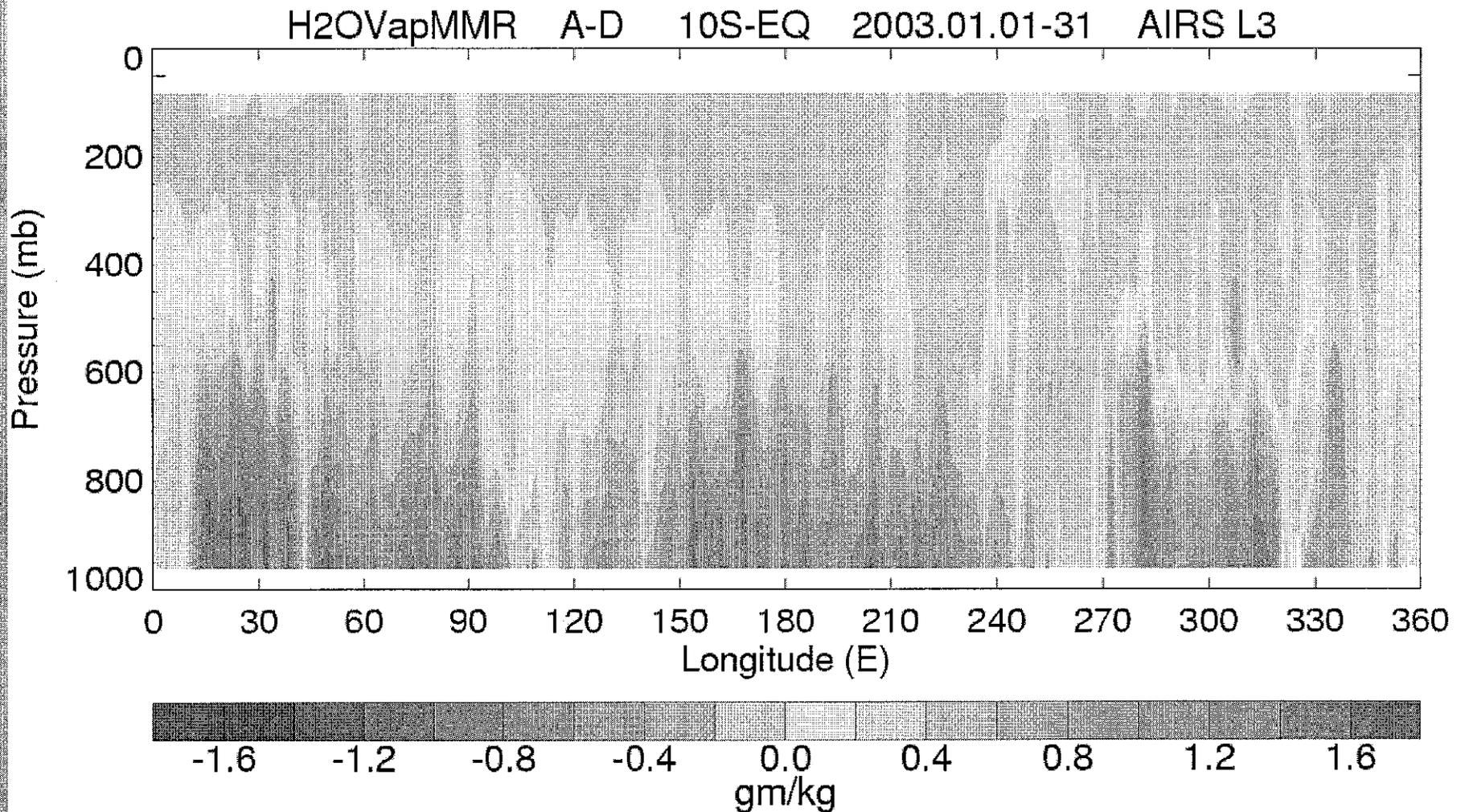


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# Time-mean cross section differences Walliser and Tian

Are differences diurnal cycle or retrieval artifacts?





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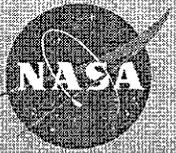
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# Scientific Visualization

## G. Shirah

- **GSFC Scientific Visualization Studio**
- **Global volumetric -like visualizations using AIRS Level 3 products**
- **Currently developing a prototype of water vapor**
- **Media friendly product**
- **Customer = outreach**
  - *General public via print and broadcast media*

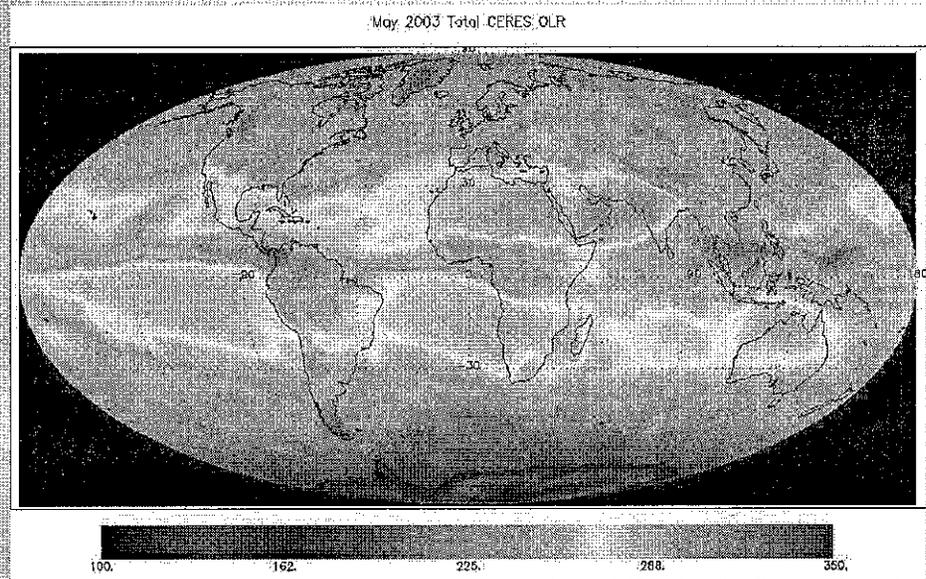
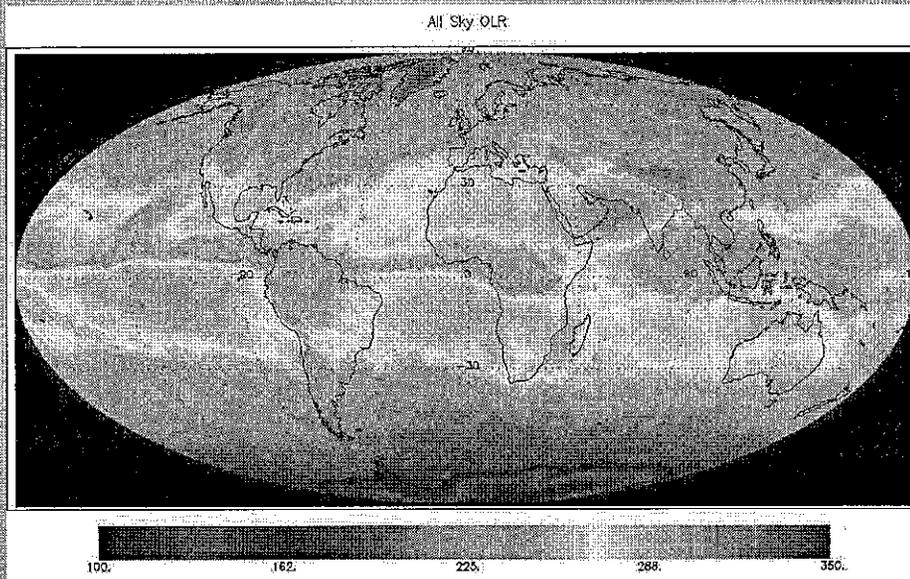


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# Outgoing Longwave Radiation from AIRS

(Sung-Yung Lee, International Radiation Symposium  
August 2004 , Busan, Korea)



- Monthly means from AIRS (left) vs CERES (right) for May 2003
- Both are gridded at 2.5 degree resolution.



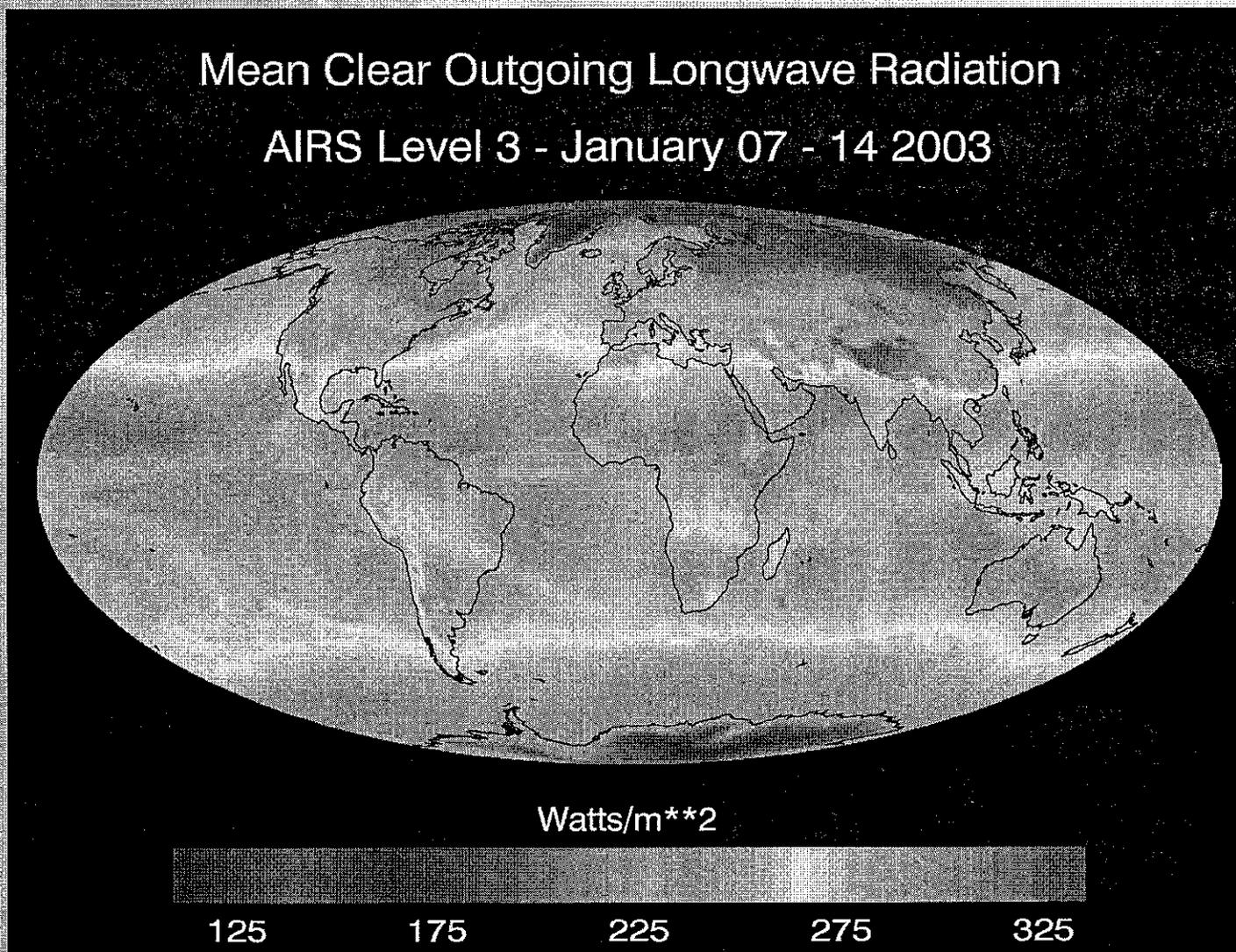
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# AIRS Level 3 Product 8-Day (from v3.0 L2)

Mean Clear Outgoing Longwave Radiation

AIRS Level 3 - January 07 - 14 2003





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# Water Vapor comparisons

## S.-Y. Lee - JPL

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- Challenges: determine preservation of information in Level 3 products
- Need for
  - separate ascending/descending products
  - microwave-only products

Total Water Vapor - Ascending  
IR/MW

Total Water Vapor - Ascending  
Microwave only



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## **Environmental Science Research, Incorporated**

- **Commercial vendor of GIS products**
  - ***ESRI is working with NCAR, through NSF to develop atmospheric data models for inclusion into GIS.***
  - ***Using AIRS Level 2 and Level 3 as part of their research and development efforts.***
    - ESRI is large (5,000+ employees) with many mature products: ArcInfo, ArcMap, ArcGIS Geostatistical Analyst, ArcGlobe
  - ***Huge set of tools available for analysis and graphical display***
    - Data fusion, mining
  - ***Diverse GIS user community***
    - Large potential user base of AIRS datasets



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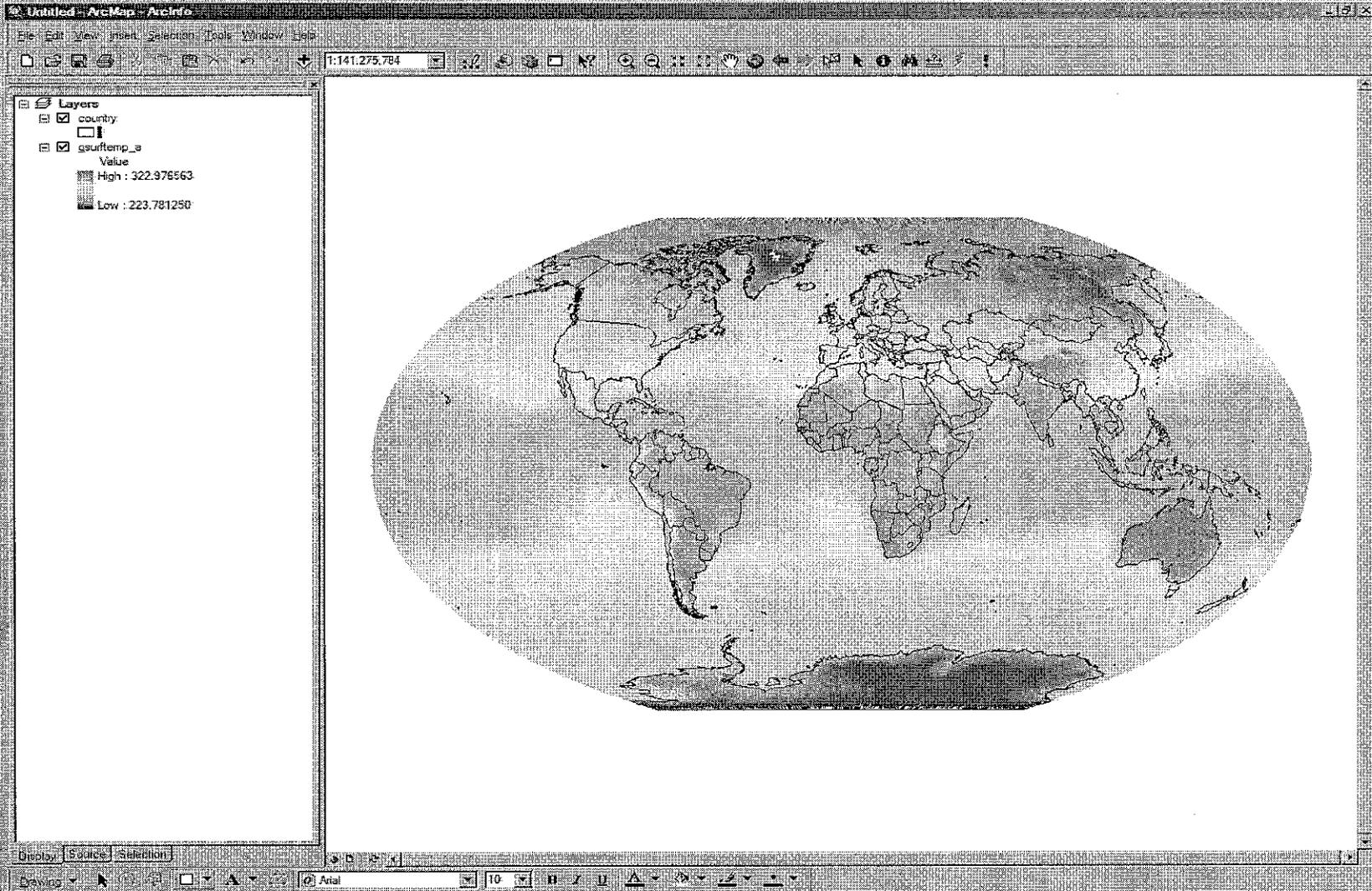
# ESRI Example Using ArcMap

*(work in progress!)*

Surface Skin Temp - January 2003

Ascending

From v3.0 Level 2





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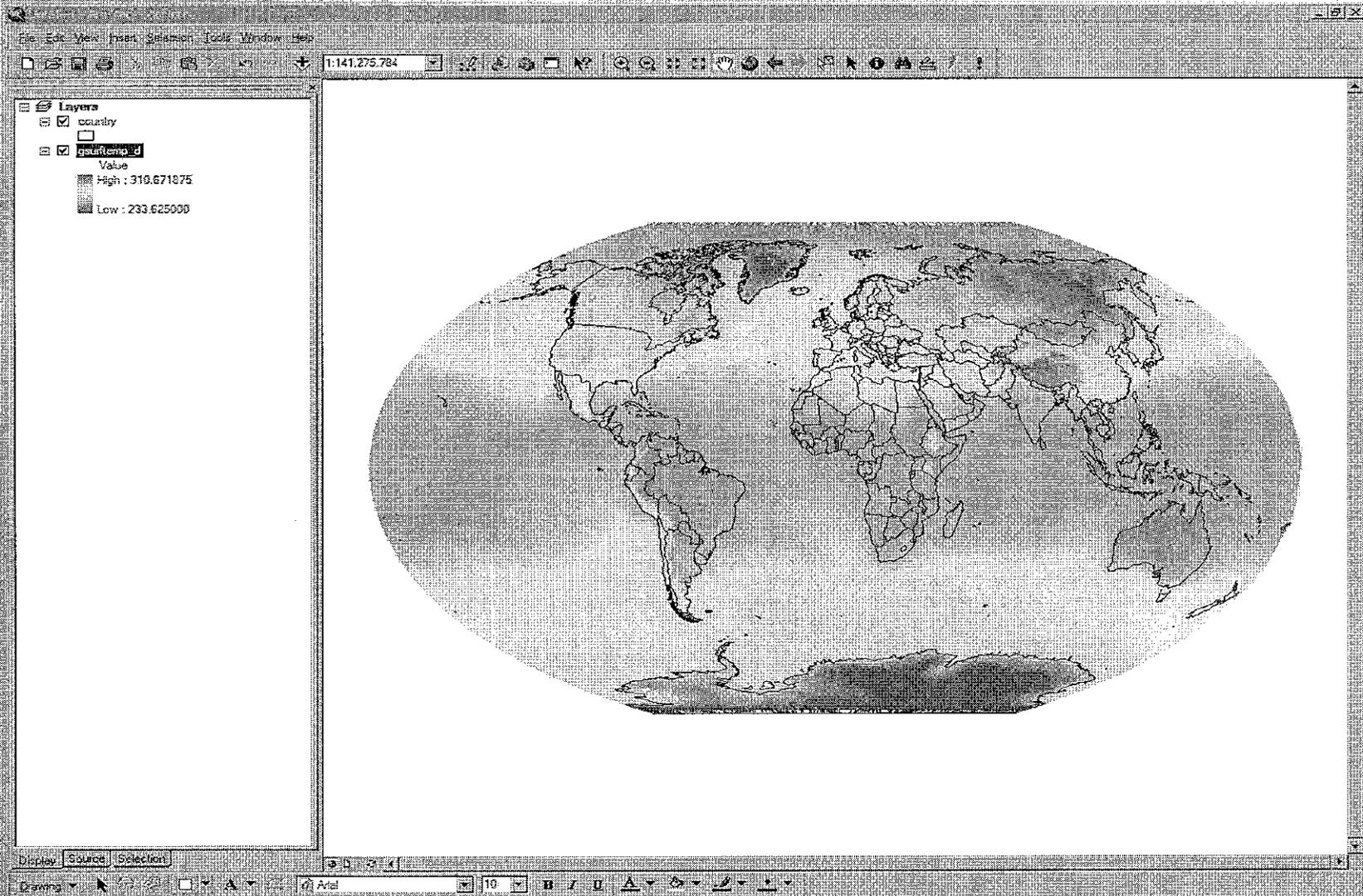
# ESRI Example Using ArcMap

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Surface Skin Temp - January 2003

Descending

From v3.0 Level 2





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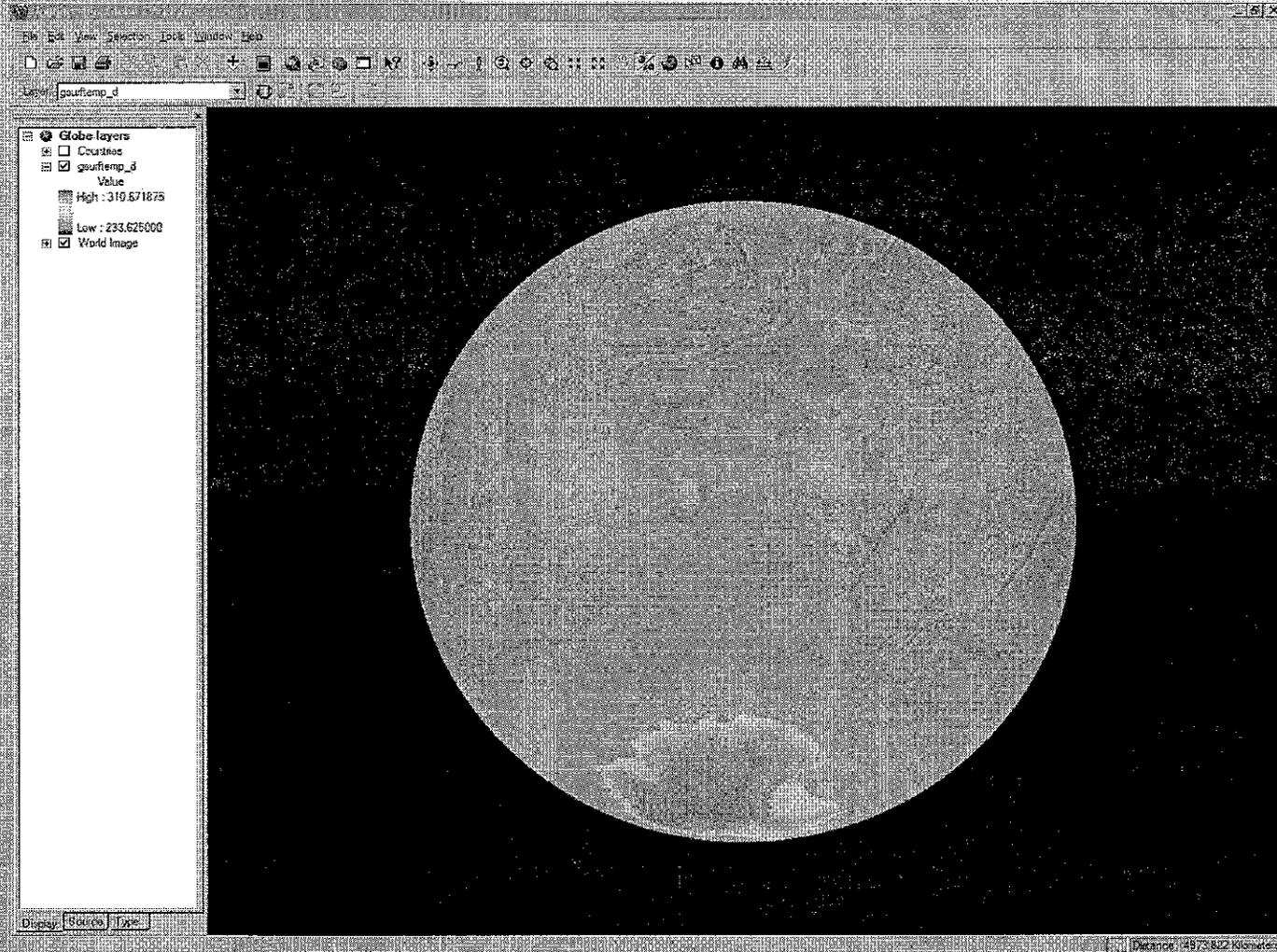
# ESRI Example Using ArcGlobe

*(work in progress!)*

Surface Skin Temp - January 2003

Descending

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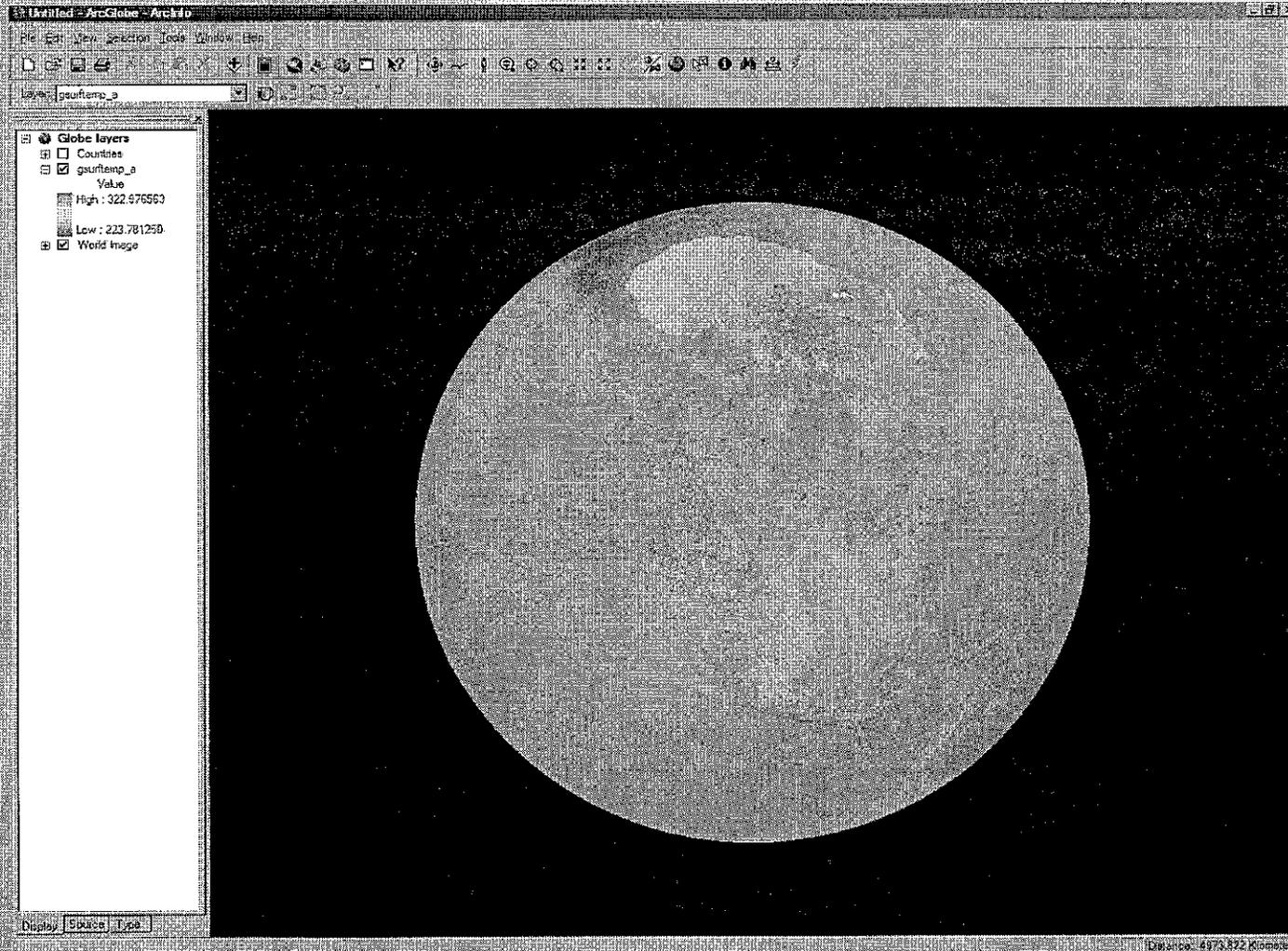
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## AIRS Level 3 Product Development Summary

- *Useful products reflecting Level 2 parameters as they currently stand.*
  
- **V5.0**
  - Investigate weighting mean by error estimate
  - Quantized Level 3 product that takes into account correlative information between parameters. Generate high-dimensional distributions within a grid cell.